SUPPORT FOR THE AMENDMENT

Support for the amendment to claim 7 is found in claims 1 and 7 as originally presented and on page 7, lines 15-16 of the specification. No new matter would be added to this application by entry of this amendment. No new issues would be raised by entry of applicants' amendment as applicants are merely addressing issues raised by the examiner.

Upon entry of this amendment, claims 1-10 will remain active in this application.

REQUEST FOR RECONSIDERATION

The claimed invention is directed to a process for preparing oligomers of linear C_4 hydrocarbons comprising separating a C_4 starting stream into streams of mainly linear C_4 hydrocarbons and mainly branched C_4 hydrocarbons followed by oligomerization of the linear C_4 hydrocarbons and separate processing of the branched C_4 hydrocarbons.

n-butene oligomers may be used in the preparation of alcohols which are used in the preparation of plasticizers or surfactant alcohols. The presence of branched alcohols in the oligomerization hydrocarbon stream can reduce the properties of the desired plasticizer. Accordingly, methods for processing n-butene oligomers are still sought.

The claimed invention addresses the problem by providing a process for preparing oligomers of linear C_4 hydrocarbons comprising separating a C_4 starting stream into linear and branched C_4 hydrocarbon fractions followed by oligomerizing the linear C_4 hydrocarbons and separately processing the branched C_4 hydrocarbons. Applicants have discovered that such a process of membrane separation provides for an efficient process for the preparation of linear C_4 hydrocarbon oligomers. Such a process is nowhere disclosed or suggested in the cited prior art.

The rejection of claims 1-10 under 35 U.S.C. § 103(a) over <u>Pierotti et al.</u> U.S.

6,440,885 as evident in <u>Harmer et al</u> U.S. 2004/0072672 in view of <u>Rath</u> U.S. 5,910,550 is

respectfully traversed.

None of the cited references disclose or suggest the claimed process in which linear

and branched C_4 hydrocarbon streams are separated wherein the linear C_4 hydrocarbon

stream is oligomerized and the branched C_4 hydrocarbon stream is separately processed.

<u>Pierotti et al.</u> describes a zeolite membrane which is described as useful for separation

processes as well as to effect chemical reactions (column 6, lines 64-65 and column 7, lines

66-67). The two tables appearing at columns 7 and 8 identify molecular species separated,

feedstocks/processes which can be reacted as well as some possible product yields. In both

tables, mixed butenes are identified as feedstocks while n-butenes are identified as either a

separated molecular species or a reaction product yielded. There is no disclosure of a step of

oligomerizing a linear C_4 hydrocarbon fraction.

The examiner cites to <u>Harmer et al.</u> example 58, asserting that it discloses

oligomerization of butenes with an aluminosilicate which "fundamentally is substantially

identical to the composition of zeolite or molecular sieve materials of <u>Pierotti et al.</u>"

*The Isomerization Catalyst of <u>Harmer et al.</u> is Fundamentally Different From the
Materials of <u>Pierotti et al.</u>*

<u>Harmer et al.</u> in example 58 conducts a solid acid catalyszed 1-butene isomerization

to cis-2-butene, trans-2-butene and isobutene. While up to 3 wt. % of oligomer is reported, it

is not identified as either a linear butene oligomer or a branched butene oligomer. Moreover

the oligomer is viewed as an undesirable by product which could be converted to a useful

isobutene by cracking (paragraph [0077]).

Applicants respectfully submit that the NAFION® PFIEP/silica microcomposite is

not fundamentally substantially identical to the zeolite or molecular sieve materials of <u>Pierotti</u>

et al. but rather acts as an acid catalyst in the isomerization of 1-butene to 2-butenes and isobutenes. Most notably NAFION®, is an **acidic** perfluorinated ion exchange polymer which contains pendant sulfonic acid groups (paragraph [0069] of Harmer et al.) This material is a preferred **catalyst** for olefin isomerization (paragraph [0061]). Thus, example 57, the example for which oligomerization is asserted, uses a composition which contains NAFION®, an acidic catalyst used to isomerize olefins.

There is no NAFION® disclosed in the zeolite membranes of Pierottie et al. Accordingly the examiner's allegation that the materials of Pierotti et al. and Harmer et al. are substantially identical lacks any credible assertion. Oligomerization is not inherent to the process of Pierotti et al. since an acidic isomerization catalyst is not used. The presence of NAFION® as the Harmer et al. isomerization catalyst precludes any credible assertion of substantial identity with the separating material of Pierotti et al.

In contrast, the claimed invention is directed to a process in which a linear C_4 fraction is oligomerized. As the cited reference fails to disclose or suggest a step of oligomerization of a linear C_4 hydrocarbon fraction, the claimed invention is not obvious from this reference.

No Suggestion of Separate Separation and Oligomerization Steps

The examiner's argument appears to be based on the view that oligomerization could be inherent to the separation process of Pierotti et al. (as evidenced by Harmer et al. and therefore the claimed process would be obvious.

Not withstanding the distinctions described above, even if the membrane of Pierottie al al. were to **concurrently** separate and oligomerize 1-butenes, the claimed invention would still not be obvious as the claims recite the preparation of a separate 1-C_4 hydrocarbon fraction and a separate b-C_4 hydrocarbon fraction, which are then **separately processed** in step b (oligomerization) and step c. The examiner's theory of inherent oligomerization

occurring during the separation process would not provide for a separate l-C_4 hydrocarbon fraction and a separate b-C_4 hydrocarbon fraction. At best the combined teachings of <u>Pierotti et al.</u> and <u>Harmer et al.</u> would describe a process in which a butene stream is reacted to produced a butene oligomer and a second butene stream. Separate l-C_4 hydrocarbon and b-C_4 hydrocarbon fractions are not described.

In contrast, the claimed invention is directed to a process in which a C_4 starting stream is separated into a separate l-C_4 hydrocarbon fraction and a separate b-C_4 hydrocarbon fraction, each of which is separately processes. As the combined disclosures of the references fails to describe the formation of a separate l-C_4 hydrocarbon fraction and a separate b-C_4 hydrocarbon fraction wherein the l-C_4 hydrocarbon fraction is oliogmerized, the claimed invention is not obvious and withdrawal of the rejection under 35 U.S.C. 103(a) is respectfully requested.

<u>Harmer et al.</u> Fails to Describe Oligomerization of Linear C_4 Hydrocarbons

In spite of the deficiencies of <u>Harmer et al.</u> noted above that the <u>Pierotti et al.</u> membrane fails to inherently oligomerize butanes in general, <u>Harmer et al.</u> fails to suggest oligomerization of linear hydrocarbons. To the contrary, <u>Harmer et al.</u>, would at best suggest formation of a by-product comprising **iso**butene oligomers, not linear C_4 oligomers, as the reference suggests that **iso**butene could be formed from cracking of butene oligomers (paragraph[0077]). The formation of a branched hydrocarbon by cracking would suggest that the oligomer was of branched hydrocarbons. There is no suggestion provided by this reference for the oligomerization of linear hydrocarbons.

<u>Rath</u> Fails to Suggest Oligomerization of Linear C_4 Hydrocarbons

<u>Rath</u> has merely been cited for a process of reacting isobutene.

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Rath fails to disclose or suggest oligomerization of a linear C_4 hydrocarbon fraction. To the contrary Rath describes formation of branched hydrocarbon oligomers by forming polyisobutene. Polyisobutene is an oligomer of **branched** C_4 hydrocarbons and therefore does not suggest formation of linear C_4 hydrocarbon oligomers. This reference fails to suggest the claim limitation of oligomerzation of linear C_4 hydrocarbons.
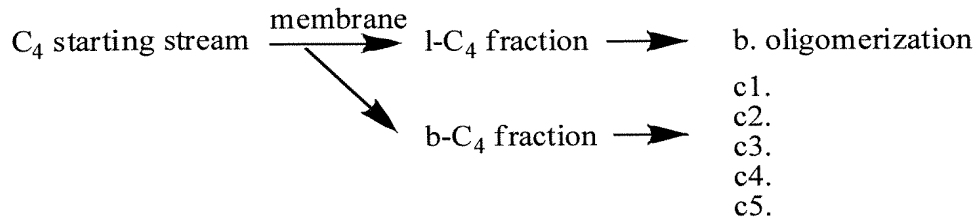
In contrast, the claimed invention is directed to a process for preparing oligomers of linear hydrocarbons by separating a butene stream into linear C_4 hydrocarbons and branched C_4 hydrocarbons and separately oligomerizing the linear C_4 hydrocarbons and reacting the branched hydrocarbons. As the cited references fail to disclose or suggest oligomerizing a linear hydrocarbon fraction and separately reacting a branched hydrocarbon fraction the claimed invention is clearly not rendered obvious from the references and accordingly withdrawal of the rejection under 35 U.S.C. § 103(a) is respectfully requested.

The rejection of claims 1-9 under 35 U.S.C. § 112, second paragraph has been obviated by appropriate amendment.

Applicants have now amended claim 7 to recite an oligomerization step which produces octenes and dodecenes. However production of octenes and dodecenes (C_8 and C_{12} produts) is implicit in the step of oligomerizing C_4 hydrocarbons, as C_8 and C_{12} are mere multiples of C_4.

The dependency of claim 8 has been adjusted to be dependent on claim 10.

As to claim 1, which claim recites the production of an oligomer, explicit in the words "oligomerizing the olefinic hydrocarbon..."A schematic representation appears below:
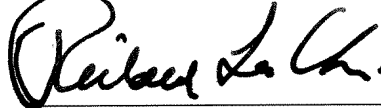
C_4 starting stream $\xrightarrow{\text{membrane}}$ l-C_4 fraction $\longrightarrow$ b. oligomerization

b-C_4 fraction $\longrightarrow$ c1.
c2.
c3.
c4.
c5.

It is clear that an oligomer is a product of the claim as it is the result of processing the l-C_4 fraction. Whether or not products c1-c5 are oligomers is irrelevant to the fact that an oligomer is formed from the l-C_4 fraction in step b and step c is related to the processing of the b-C_4 fraction and not a processing of the oligomer formed from the l-C_4 fraction. The b-C_4 fraction is processed independently of the l-C_4 fraction. In view of applicants' amendment, withdrawal of this ground of rejection is respectfully requested.

Applicants submit that this application is now in condition for allowance and early notification of such action is earnestly solicited.

Respectfully submitted,

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